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L13: Entry 1 of 1 File: USPT Jun 2, 1998

DOCUMENT-IDENTIFIER: US 5761442 A
TITLE: Predictive neural network means and method for selecting a portfolio of securities wherein each network has been trained using data relating to a corresponding security

Abstract Text (1):
A data processing system and method for selecting securities and constructing an investment portfolio is based on a set of artificial neural networks which are designed to model and track the performance of each security in a given capital market and output a parameter which is related to the expected risk adjusted return for the security. Each artificial neural network is trained using a number of fundamental and price and volume history input parameters about the security and the underlying index. The system combines the expected return/appreciation potential data for each security via an optimization process to construct an investment portfolio which satisfies predetermined aggregate statistics. The data processing system receives input from the capital market and periodically evaluates the performance of the investment portfolio, rebalancing it whenever necessary to correct performance degradations.

Brief Summary Text (2):
The present invention relates to a financial data processing system and method designed for investors whose objective is to obtain a return on their investment portfolio which is superior to the broad index benchmarks of a given capital market. More particularly, the system and method of this invention are preferably carried out using artificial neural networks capable of estimating the appreciation potential of the individual securities in a capital market. The system of this invention uses the appreciation estimates for the individual securities to create and administer investment portfolios with varying time horizons.

Brief Summary Text (4):
Individual and institutional investors apply various selection and optimization strategies in the process of creating a securities portfolio which can provide higher return on their capital investment. Such strategies are frequently based on research in a particular industry, historical price data for individual stocks, analysis of fundamental data, etc. A common problem in formulating an investment strategy is, however, the overwhelming amount of the available market information which cannot be readily interpreted. For this reason, investors are confined to specific techniques which rely on limited subsets of data.

Brief Summary Text (19):
Yet another object of the present invention is to provide a data processing system and method to create an investment portfolio subject to certain risk parameters and to rebalance the portfolio periodically to increase the expected return of the portfolio while maintaining the investment risk at a similar level.

Brief Summary Text (25):
The appreciation potential of each stock determined by the neural nets is used to generate an optimized investment portfolio comprising a selected number of stocks. Each stock is allocated a weight based on its estimated performance potential within the prescribed future time period and other parameters related to the investment risk. These weights form the basis of both long and short portfolios. The "long" portfolio includes a prespecified number of stocks which are estimated to have the best appreciation potential. Conversely, the "short" portfolio includes stocks which are

estimated to have the worst performance potential for the predetermined time period. An investor utilizing the system of the present invention may then make investment decisions (such as buying or selling stocks) on the basis of the suggested model portfolios.

Brief Summary Text (26):
More specifically, the portfolio of stocks is created in accordance with the present invention using a portfolio optimizer which employs the performance potentials estimated by the neural nets, a measure of how good the estimates are, forecasts of economic and financial variables, risk allocation factors, investor preferences and guidelines, and other factors. This optimizer is designed to suggest a portfolio of stocks which is expected to have similar risk as the overall capital market (or risk according to the investor's preference), but to outperform the investment return of the associated market benchmarks over a predetermined period of time.

Brief Summary Text (28):
The method and system of the present invention provide an effective and efficient tool for optimizing investment decisions by utilizing the capability of neural nets to take into account complex relationships among different market and stock-specific factors. The method and system further incorporate data processing optimization techniques that use the performance estimates for each stock obtained from the neural nets to construct portfolios that improve the returns on capital investments.

Detailed Description Text (5):
The combined technical and fundamental information from blocks 10, 20 and 30 is then passed to pre-processing block 40, which indicates the functions performed by the system 305 in FIG. 1. Pre-processing block 40 generates a number of data sequences, each sequence representing the values of certain parameters of the stock computed at predetermined time intervals in the past, preferably one week apart. These data sequences are specific for each stock and are subsequently used to train the neural net for each stock. Each data sequence has been historically found to relate to the performance of the stocks and thus may be used as a predictor of their future performance. Appendix A provides a listing of the data sequences of the preferred embodiment of the present invention, along with their definitions, which are preferably generated at block 40. This data includes the parameter BETA (.beta.) which is a measure of volatility of the stock relative to an underlying benchmark; ALPHA (.alpha.) which is a measure of the excess return of the stock over the beta-adjusted benchmark; the standard deviation of the parameter ALPHA computed over a predetermined period of time; the slope of the earnings surprise rankings and other parameters, as defined in Appendix A and explained in more detail below. On the basis of the present disclosure, a person skilled in the art will be able to use other parameters as well.

Detailed Description Text (9):
Block 60 in FIG. 2 indicates the operation of the system 310 in FIG. 1, which is used to create an optimized stock portfolio on the basis of the appreciation potential estimates. In this block each stock is allocated a weight proportional to its estimated appreciation potential within the predetermined future time period, such that the risk constraints and investor preferences are satisfied. Such weighing generates model long and short portfolios. These portfolios comprise a selected number of stocks which are estimated to have respectively the best and the worst appreciation potential over the predetermined period of time. An investor utilizing the system of the present invention may then make investment decisions on the basis of the suggested model portfolios. In the following description only the "long" portfolio, comprising stocks estimated to have the best performance over the prespecified period of time, will be considered because the selection process for the "short" portfolio, comprising stocks expected to have the worst performance, is essentially identical (especially if modeled using negative weights during the portfolio construction process).

Detailed Description Text (10):
Finally, in block 70 the system of the present invention continuously monitors the performance of the selected stocks and compares the return of the model portfolio to the overall investment return in the capital market. Should the output of the neural nets for the specific time period indicate that the appreciation potential of certain stocks has changed significantly, data processing system 310 in FIG. 1 may rebalance the composition of the suggested optimized model portfolio, so that the investors

using the system may adjust their positions in the capital market accordingly.

Detailed Description Text (15):
The following steps 157-205 illustrate the sequence used in one embodiment of the present invention to compute values for all remaining input parameters, as defined in Appendix A. Thus, in steps 157 the power factor is computed, in steps 160 and 165 the negative and the positive power coefficients are computed, respectively; in step 170 the power slope is computed; in step 175, the LPM factor is computed; in step 180 the historical ALPHA parameter for the stock is computed; in step 185 the system computes the residual, in step 190 the long-term Price/Earnings (P/E) ratio based on scaled earnings is computed. In steps 194 the relative P/E parameter is computed, in step 196 the Average Volume factor for the stock is obtained. In step 198, preprocessing system 305 computes an estimate for the future stock return and on the basis of this estimate computes in step 200 values for the ALPHA parameter of the stock for a period M weeks into the future (preferably, the computation is done for 4, 12 and 24 weeks). The last step 205 in FIG. 3 illustrates the separation of the available input data into a training, testing, validation and production (referred to as: R, S, V, P, respectively) sets as explained in more detail below and illustrated in FIG. 6.

Detailed Description Text (38):
Referring back to FIG. 1, the selection of an optimized portfolio of stocks is done in accordance with the preferred embodiment of the present invention using a program implemented in the data processing system 310. Data processing system 310 receives and stores in storage 330 data about the appreciation potential of each stock in the capital market and then correlates this input data with risk factors and investor defined constraints stored in storage 320 to generate an optimized portfolio of stocks. Data processing system 310 further models the performance of the overall market, and predicts the future correlation between the return of the selected portfolio and at least one index of the capital market to ensure that the portfolio will provide a desired investment return over the predetermined period of time.

Detailed Description Text (39):
Typically, the selected optimized portfolio contains much fewer stocks than the underlying performance benchmark portfolio (such as the S&P 500 Index or the S&P 400 MidCap Index). This is because the portfolio creation process concentrates on stocks that have a large appreciation potential along with favorable liquidity and risk characteristics.

Detailed Description Text (41):
In operation, data processing system 330 continuously monitors the performance of the optimized portfolio and compares its overall investment return to the broad market benchmarks of the associated capital market. In addition, neural nets 300 compute the appreciation potential parameter ALPHA for each stock in the market. This information is processed by the portfolio optimizer in system 310 which determines the composition of the optimized portfolio. In the U.S. capital markets this portfolio includes about 50-70 stocks; for example, the MidCap portfolio has about 60 stocks out of a total of 400 stocks. If the system detects a degradation in the cumulative ALPHA parameter of the portfolio, or if the neural nets indicate high appreciation potential in stocks which are not included in the optimized portfolio or low potential in stocks which are part of the optimal portfolio, the composition of the portfolio can be changed.

Detailed Description Text (42):
In accordance with a preferred embodiment of the present invention, rebalancing of the optimized portfolio can be effected at regular time intervals, such as one week, or be triggered by large variations in the output of the neural nets. In particular, data processing system 310 receives input about the predicted ALPHA parameter of each stock in the market from the neural nets. This information is analyzed along with other factors, such as the BETA parameters of the stocks, market sector constraints, transaction costs and other data stored in storage 320 and 330 to check whether the existing stock portfolio's expected return can be improved. As a result of the analysis, the portfolio optimizer may suggest rebalancing the previously optimized portfolio by one or many of the following: 1) changing the existing stock positions in the portfolio, e.g. suggesting a 3% position in a particular stock from an earlier 2.1% position; or 2) adding a new stock to the portfolio with an appropriate weight; or 3) deleting an existing stock from the portfolio. The suggested changes can then be

implemented by a human operator.

Detailed Description Text (71):
Standard Deviation of Alpha value. Alpha is the difference between the stock's actual return and the expected return (based on its Beta). (e.g. 11.9753)

CLAIMS:

1. A system comprising one or more computers for selecting a portfolio of securities expected to provide, within a predetermined period of time, a return superior to a risk-adjusted performance of a selected market index, the system comprising:

a plurality of predictive neural network means for estimating an appreciation potential of participating securities of a capital market over the period of time, each of the neural network means estimating the appreciation potential of a separate individual security of the participating securities, wherein each of the neural network means has been trained using data relating to a corresponding security so as to adjust weights of each of the neural network means;

portfolio construction means for selecting an investment portfolio on the basis of the estimated appreciation potential of the participating securities, determined by the plurality of the predictive neural networks, such that the expected return on the selected investment portfolio over the predetermined period of time is superior to the performance of the selected index; and

means for receiving information about the participating securities.

3. The system of claim 2 further comprising:

means for computing a tracking error indicative of the deviation of the determined performance of the investment portfolio from the risk-adjusted index value of the capital market; and

means for rebalancing the investment portfolio on the basis of the input from the means for computing.

11. A method for administering an investment portfolio of securities expected to provide, within a predetermined limited period of time, a return superior to performance of a selected market index, the method comprising the steps of:

estimating an appreciation potential of participating securities of a capital market over the limited period of time using a plurality of predictive neural network means, wherein each of the predictive neural network means estimating appreciation potential of a separate individual security of the participating securities, wherein each of the neural network means has been trained using data relating to a corresponding security so as to adjust weights of each of the neural network means;

selecting an optimized investment portfolio on the basis of the estimated appreciation potential of the participating securities, determined by the plurality of the neural network means, such that the expected return on the selected investment portfolio over the predetermined period of time is superior to the performance of the selected index; and

receiving information on each security of the selected investment portfolio.

13. The method of claim 12 further comprising the steps of:

computing a tracking error indicative of the deviation of the determined performance of the investment portfolio from the index value of the capital market; and

rebalancing the investment portfolio on the basis of the computed tracking error.

18. A system comprising one or more computers for selecting a portfolio of securities which is expected to provide, within a predetermined period of time, a return superior to the risk-adjusted performance of a selected market index, comprising:

a plurality of predictive neural networks for estimating an appreciation potential of participating securities of a capital market over the period of time, wherein each of the neural networks is estimating the appreciation potential of a separate individual security of the participating securities, wherein each of the neural networks has been trained using data relating to a corresponding security so as to adjust weights of each of the neural networks;

at least one input data preprocessor for generating data for each of the plurality of the neural networks, comprising:

first means for receiving for each of the participating securities of the capital market current and historical trading information;

second means for receiving for each of the participating securities of the capital market fundamental information about the security, such fundamental information comprising earnings related data; and

at least one processor for constructing for each of the participating securities of the capital market a set of input data sequences generated from the capital market current and historical trade information and fundamental information, said data sequences being supplied to the the plurality of predictive neural networks for forming an estimate of the appreciation potential of each security over the predetermined period of time, wherein each of the neural networks estimates the appreciation potential of a separate individual security of the participating securities.

23. A method for computerized selection of a portfolio of securities expected to provide, within a predetermined period of time, a return superior to the risk-adjusted performance of a select market index, comprising the steps of:

for each participating security of a capital market, electronically acquiring fundamental and price related information;

electronically analyzing the acquired information for each participating security using a separate predictive neural network which has been trained using data relating to a corresponding security so as to adjust weights of the neural network, to estimate the appreciation potential of each participating security relative to the select market index; and

selecting an investment portfolio on the basis of the estimated appreciation potentials for the participating securities of the capital market such that the expected return on the selected investment portfolio is superior to the performance of the select market index.

WEST Search History

DATE: Friday, April 04, 2003

Set Name side by side	Query	Hit Count	Set Name result set
	DB=USPT; PLUR=YES; OP=OR		
L13	L12 and l11	1	L13
L12	return near7 difference	3744	L12
L11	L10 and l9	4	L11
L10	coefficient	235787	L10
L9	L8 and l7	9	L9
L8	(benchmark$ or bench adj3 mark$) near9 return$	30	L8
L7	L6 and l5	37	L7
L6	portfolio near9 return	111	L6
L5	portfolio near7 performance	92	L5
L4	L3 and l2	33	L4
L3	benchmark or bench adj3 mark	3906	L3
L2	portfolio near7 return$	108	L2
L1	porfolio near7 return$	0	L1

END OF SEARCH HISTORY

(alpha or beta) parameter, factor, variable, coefficient

omega

compare, difference, substact

portfolio, benchmark

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5873071

5761442

6453303

WEST Search History

DATE: Friday, April 04, 2003

Set Name side by side	Query	Hit Count	Set Name result set
	DB=USPT; PLUR=YES; OP=OR		
L19	L18 and l17	3	L19
L18	(alpha or beta) near7 (parameter or variable or factor or coefficient)	30712	L18
L17	L16 and l12	9	L17
L16	L15 and l14	101	L16
L15	benchmark$ or bench adj3 mark$	4191	L15
L14	portfolio	1432	L14
L13	L12 and l11	1	L13
L12	return near7 difference	3744	L12
L11	L10 and l9	4	L11
L10	coefficient	235787	L10
L9	L8 and l7	9	L9
L8	(benchmark$ or bench adj3 mark$) near9 return$	30	L8
L7	L6 and l5	37	L7
L6	portfolio near9 return	111	L6
L5	portfolio near7 performance	92	L5
L4	L3 and l2	33	L4
L3	benchmark or bench adj3 mark	3906	L3
L2	portfolio near7 return$	108	L2
L1	porfolio near7 return$	0	L1

END OF SEARCH HISTORY